CHADBOURNE DIVERSION, FWP #12-17

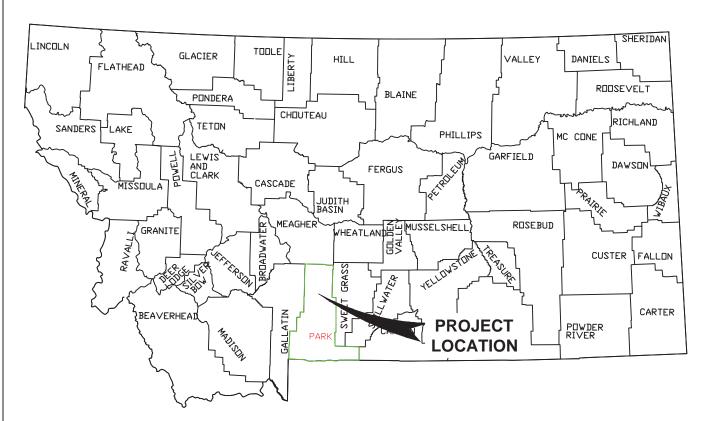
DIVERSION RETROFIT & FISHERIES ENHANCEMENT PROJECT

Located in Section 13, Township 1N, Range 9E Latitude = 45.8297 North; Longitude = 110.5595 West Park County, Montana

OWNER: LOWER SHIELDS RIVER CANAL COMPANY

COOPERATING AGENCY: MONTANA FISH, WILDLIFE & PARKS

JUNE 27, 2012



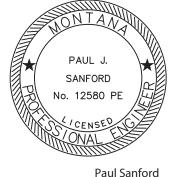
120 SOUTH MAIN STREET, LOWER LEVEL BOZEMAN, MT 59718 STANLEY, ND 58784 PHONE (406) 582-0221 PHONE (701) 629-0245 FAX (406) 582-5770 www.alliedendineering.com

Civil Engineering Geotechnical Engineering Land Surveying



PROJECT ENGINEER: PAU STRUCTURAL ENGINEER: ERI GEOTECHNICAL ENGINEER: LEE STAFF ENGINEER: ROF FISHERIES & HYDRAULIC ENGINEER: MA' FISHERIES & HYDRAULIC ENGINEER: TON SURVEYOR: KYI

PAUL SANFORD, PE ERIK GARBERG, PE LEE EVANS, PE RORY S. ROMEY, EI MATT BLANK, PE, PhD TOM COLEMAN, PE KYLE THOMPSON, LS



Paul J. Sarlod 2012.06.27

13:47:05 -06'00

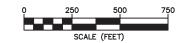
NOTE: REFER TO GENERAL NOTE 1 ON PLAN SHEET N-1 FOR DESCRIPTION AND IDENTIFICATION OF ENGINEER IN RESPONSIBLE CHARGE FOR THE VARIOUS PROJECT ELEMENTS.

SHEET INDEX

SHEET NO.		SHEET NO.	
T-1	TITLE PAGE	D-1	DETAILS - FISH BARRIER & CHANNEL
N-1	ABBREVIATIONS AND NOTATIONS	D-2	DETAILS - FISH BARRIER & CHANNEL
H-1	SURVEY CONTROL AND EXISTING CONDITIONS	D-3	DETAILS - FISH BARRIER & CHANNEL
G-1	PROJECT OVERVIEW	D-4	DETAILS - FISH BARRIER & CHANNEL
BMP-1	BEST MANAGEMENT PRACTICES PLAN	D-5	DETAILS - FISH BARRIER & CHANNEL
GP-1	GRADING PLAN	D-6	DETAILS - FISH TRAP & CHANNEL
DP-1	DESIGN PLAN	D-7	DETAILS - FISH TRAP & CHANNEL
PR-1	PROFILE - CHANNEL	D-8	DETAILS - FISH TRAP & CHANNEL
PR-2	PROFILE - FISH TRAP CHANNEL	D-9	DETAILS - FISH TRAP & CHANNEL
XS-1	CROSS-SECTION OVERVIEW	CW-1	CONTROL OF WATER
XS-2	CROSS-SECTIONS - CHANNEL	CW-2	CONTROL OF WATER DETAILS
XS-3	CROSS-SECTIONS - CHANNEL		
XS-4	CROSS-SECTIONS - CHANNEL		
XS-5	CROSS-SECTIONS - CHANNEL		



VICINITY MAP



CONSTRUCTION PLANS

Site Remediation Water Resources Ecological Sciences EHS Management



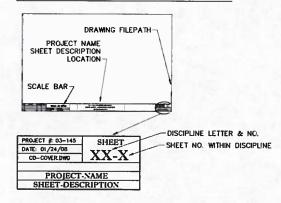
Civil Engineering Geotechnical Engineeri Land Surveying Water Resources



PROJECT #:10-146.20 DATE: 06/27/2012

> CHADBOURNE DIVERSION COVER SHEET

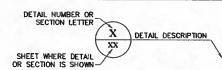
STANDARD BORDER FORMAT



STANDARD SHEET DESIGNATION

LETTER	DISCIPLINE
T-X	TITLE PAGE
N-X	ABBREVIATIONS & NOTATIONS
H-X	SURVEY CONTROL
G-X	OVERVIEW PLANS
BMP-X	BEST MANAGEMENT PRACTICES PLANS
GP-X	GRADING PLANS
DP-X	DESIGN PLANS
VP-X	VEGETATION PLANS
PR-X	PROFILES
XS-X	CROSS-SECTIONS
D-X	DETAILS
PH-X	PHASING PLANS
CWX	CONTROL OF WATER PLANS

PLAN SHEET DETAIL CALLOUTS



GENERAL NOTES:

THIS PLAN SET WAS DEVELOPED UNDER THE RESPONSIBLE CHARGE OF PAUL SANFORD, PE OF ALLIED ENGINEERING SERVICES, INC. AND MATT BLANK PE, PhD, OF ERM GROUP, INC. (OASIS ENVIRONMENTAL) AS DESCRIBED BELOW.

PAUL SANFORD IS THE CIVIL ENGINEER IN RESPONSIBLE CHARGE FOR THE CIVIL ENGINEERING COMPONENTS OF THE PROJECT. HIS STAMP APPEARS ON THE COVER SHEET OF THE PLANS.

MATT BLANK IS THE FISHERIES AND HYDRAULIC ENGINEER IN RESPONSIBLE CHARGE FOR THE HYDRAULIC ANALYSIS AND THE GEOMETRIC LAYOUT OF THE FISH TRAP AND FISH BARRIER. HIS STAMP APPEARS BELOW.



2. PERMIT ACQUISITION IS THE RESPONSIBILITY OF FWP. CONTRACTOR WILL SATISFY THE CONDITIONS OF THE PERMITS. PERMITS INCLUDE STATE 124 AND 318, FEDERAL 404, AND PARK COUNTY FLOOD PLAIN PERMIT. REFER TO SPECIFICATION SECTION 02210 PROTECTION OF THE ENVIRONMENT FOR DISCUSSION OF CONSTRUCTION DEWATERING PERMIT. IF THIS PERMIT IS NECESSARY, CONTRACTOR WILL BE RESPONSIBLE FOR OBTAINING IT.

LEGEND

6165	INDEX CONTOUR - EG (5 FT INTERVAL) CONTOUR MINOR - EG (1 FT INTERVAL)	CONCRETE
6165	INDEX CONTOUR - FG (5 FT INTERVAL) CONTOUR MINOR - FG (1 FT INTERVAL)	BEDDING
	LIMITS OF DISTURBANCE STREAM CENTERLINE SURVEY CONTROL POINT	TOPSOIL
	TEST PIT — EXT'G EDGE OF GRAVEL DRIVEWAY	NATIVE MATERIAL
	EXT'G OVERHEAD POWER EXT'G FENCE EXISTING VEGETATION	COMMON BACKFILL
⊗	STRAW WATTLE PORTAGE SIGN	ROCK ARMOR
		SEEDING

ABBREVIATIONS:

AESI	ALLIED ENGINEERING SERVICES,	INC.
AVG	AVERAGE	

CENTERLINE CUBIC YARD

DIA DBH DWG DIAMETER AT BREAST HEIGHT

EA EG ELEV EXT'G EACH EXISTING GRADE ELEVATION EXISTING

FES FG FT FWP FABRIC ENCAPSULATED SOIL FINISHED GRADE

FEET MT. DEPT. of FISH WILDLIFE & PARKS

HORZ HORIZONTAL HIGHWAY

LINEAR FEET LOWER SHIELDS RIVER CANAL COMPANY LEFT

MAT'L MAX MH MIN MATERIAL MAXIMUM MANHOLE MINIMUM

NORTH NOT IN CONTRACT

PL PROP PROPERTY LINE PROPERTY

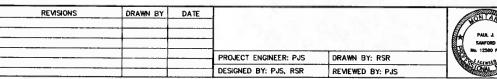
R ROW RT RADIUS RIGHT OF WAY RIGHT

S SECT STA STD SOUTH SECTION STATION STANDARD

TYP TYPICAL

UG UNDERGROUND VERT VERTICAL

WITHOUT WATER SURFACE ELEVATION





SHIELDS RIVER - CHADBOURNE DIVERSION RETROFIT ABBREVIATIONS AND NOTATIONS PARK COUNTY, MONTANA



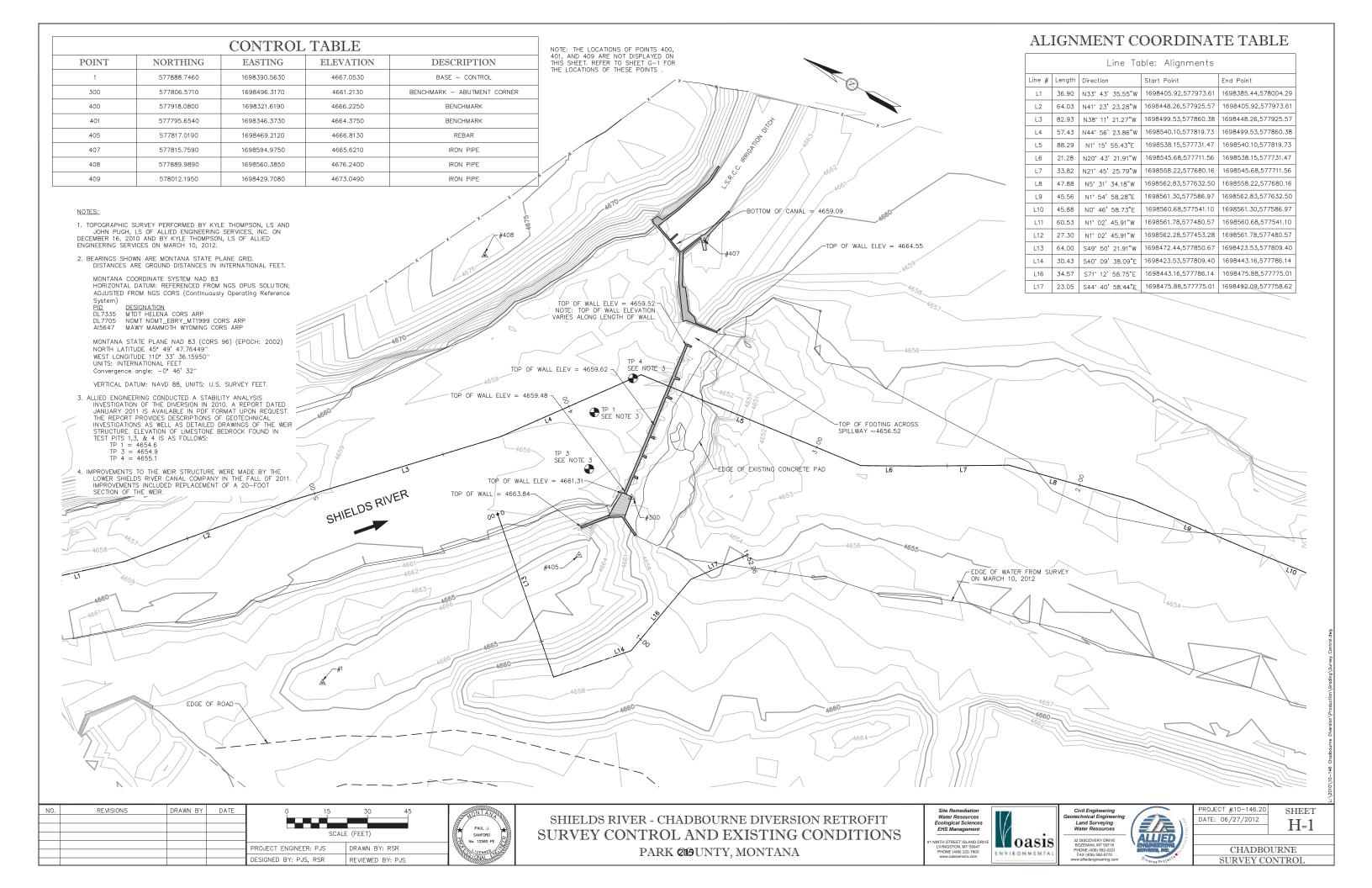


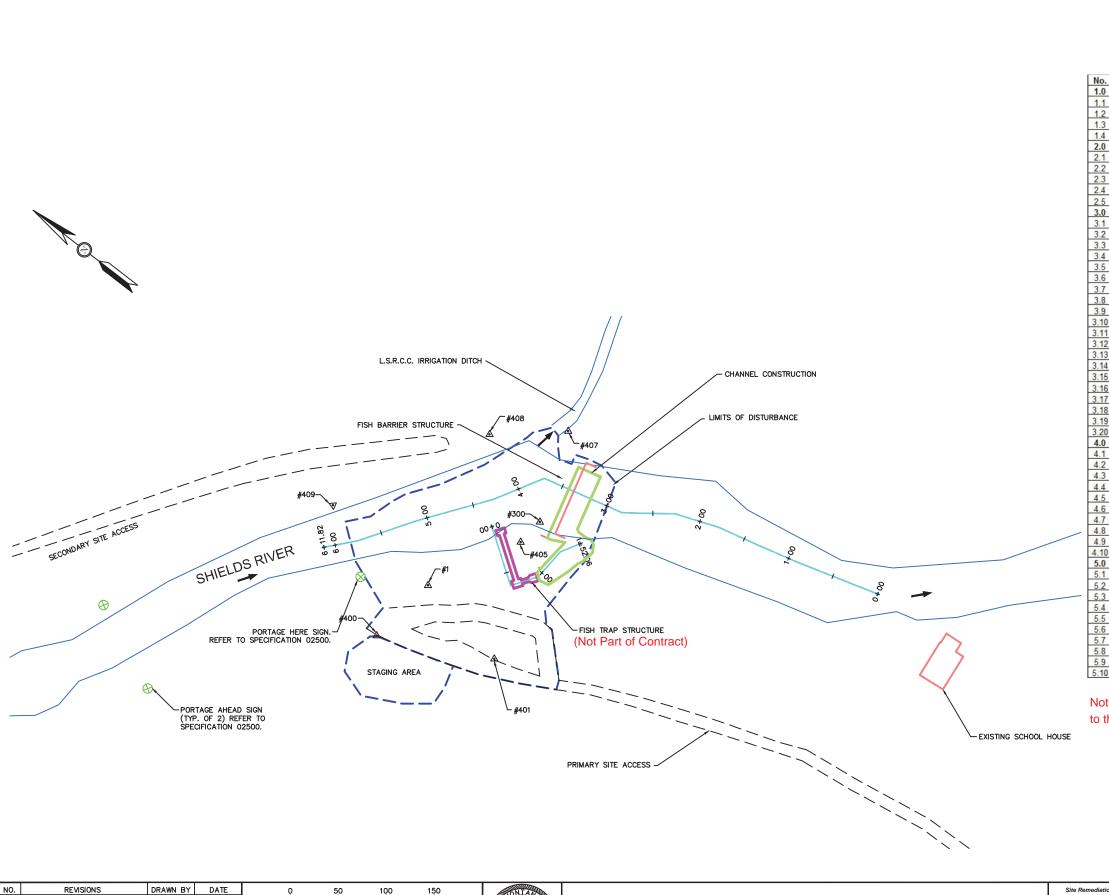




PROJECT #:10-146.20 SHEET DATE: 06/27/2012 N-1

> CHADBOURNE ABBREVIATIONS





No.	Materials and Activity	Quantity	Unit
1.0	Site Preparation & Revegetation		
1.1	Mobilization/Demobilization	1	Lump
1.2	Maintain and Resurface Access Roads	1	Lump
1.3	Seed	1,010	SY
1.4	Topsoil (Alternate Bid Item)	80	Ton
2.0	Erosion Control and Control of Water		
2.1	Diversion Dam - Stage 1	1	Lump
2.2	Diversion Dam - Stage 2		Lump
2.3	Excavation Dewatering		Lump
2.4	Erosion Control Fabric (provisional item)	_	SY
2.5	Straw Wattle	150	LF
	Fish Trap Structure		
3.1	Clearing & Grubbing		Acres
3.2	Gross Excavation		CY
3.3	Bedding		CY
3.4	Concrete Intake Box		Lump
3.5	Canal Gate - 18 inch (Waterman C-10 or Equal)		Each
	Transport Pipe - 18-inch CMP		LF
3.7	Transport Pipe (18-inch CMP) - 90 Degree Elbows		Each
	Concrete Energy Dissipation Box		Lump
	Concrete Transport Channel		Lump
	Pipe Exiting Transport Channel - 12 inch C900 PVC (Alternate Bid Item)		LF
	Pipe Exiting Transport Channel - 12 inch Gate Valve, Box & Key (Alternate Bid Item)		Each
	Pipe Exiting Transport Channel - 12 inch 90 Degree Bend (Alternate Bid Item)		Each
	Concrete V-Trap Structure		Lump
	Fish Screen (Installed)	_	SF
	Canal Gate - 6 inch (Waterman C-10 or Equal)		Each
	Fish Screen - Extra Set Delivered to FWP Office (Alternate Bid Item)		SF
	Hook Step Ladder - Delivered to FWP Office		Each
	Chain Link Covers for Fish Trap Structure		SF
	Common Backfill Dispose of Excess Gross Excavation		CY
	Fish Barrier Structure	405	CT
	Demolition of Portions of Existing Concrete/Rock Apron	4	Lump
	Structural Backfill (provisional item)	- '	Lump
	Flowable Fill (provisional item)		
4.4	Bedding		CY
	Geotextile Fabric		SY
4.6	Concrete Ogee Spillway		CY
	Concrete Splash Pad		CY
	Concrete Retaining Wall		CY
	Irrigation Diversion Hardware		Lump
	Portage Signs		Each
	Channel Construction	1	
5.1	Clearing & Grubbing	0.01	Acres
5.2	Salvage & Replace Willows	400	
5.3	Gross Excavation		CY
5.4	Rock Type 1 - Erosion Protection Downstream of Splash Pad		Ton
5.5	Rock Type 2 - Step Pool Channel Vane Rock		Ton
5.6	Rock Type 3 - Step Pool Channel ESM	65	Ton
5.7	Rock Type 4 - Step Pool Channel 1-inch Minus Sandy Gravel	14	Ton
5.8	Rock Type 5 - Oversize Cobbles for Overflow Channel		Ton
5.9	Subgrade Flow Interceptor Fabric for Step Pool Channel	25	SY
5.10	Fabric Encapsulated Soil - Bank Tie In	20	LF

Note: The Fish Trap Structure and the Step Pool Channel leading from the trap to the river are not part of this contract.

REVISIONS

PROJECT ENGINEER: PJS DRAWN BY: RSR

REVIEWED BY: PJS

DESIGNED BY: PJS, RSR



PROJECT OVERVIEW PARK **200** UNTY, MONTANA

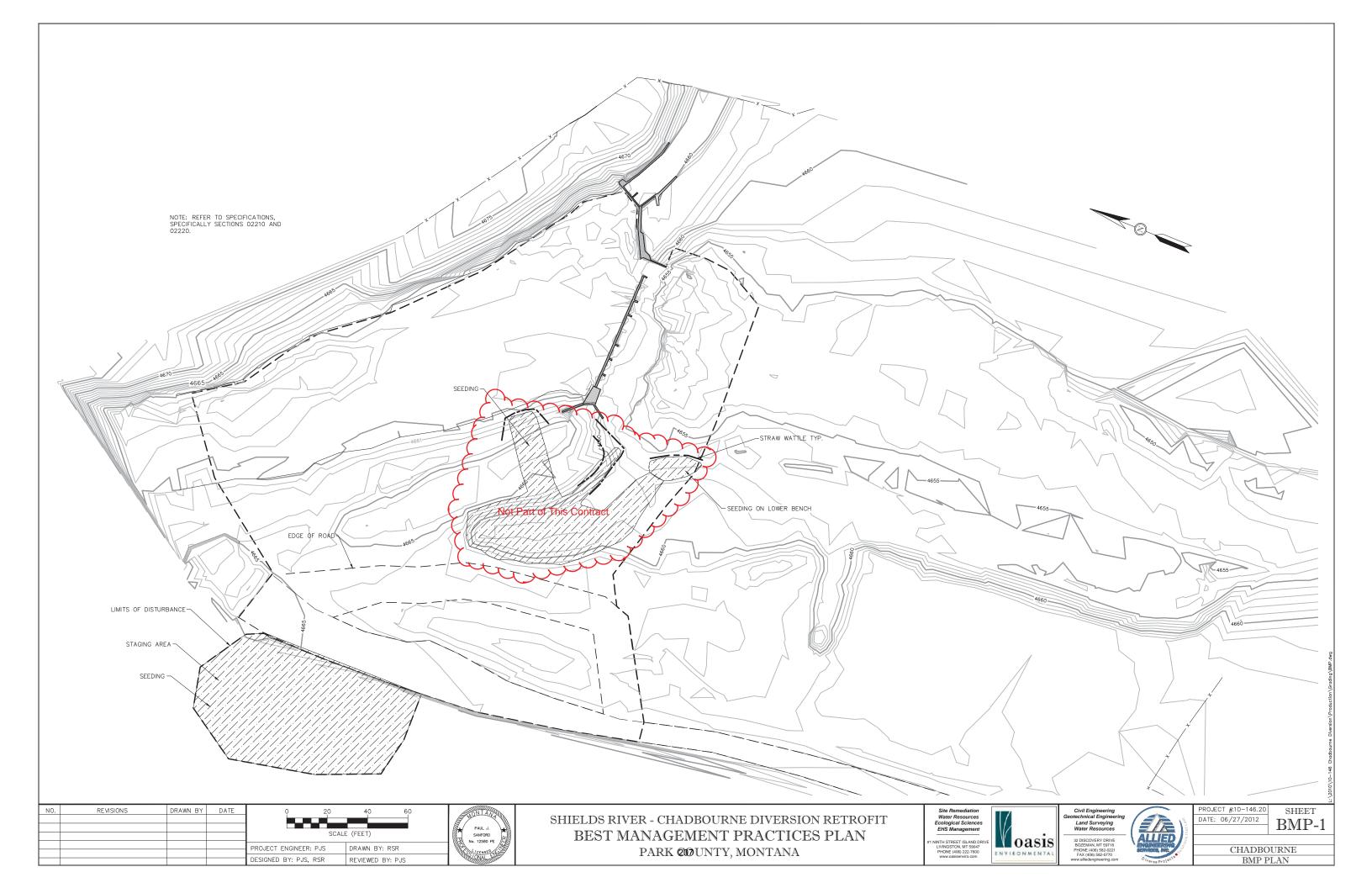


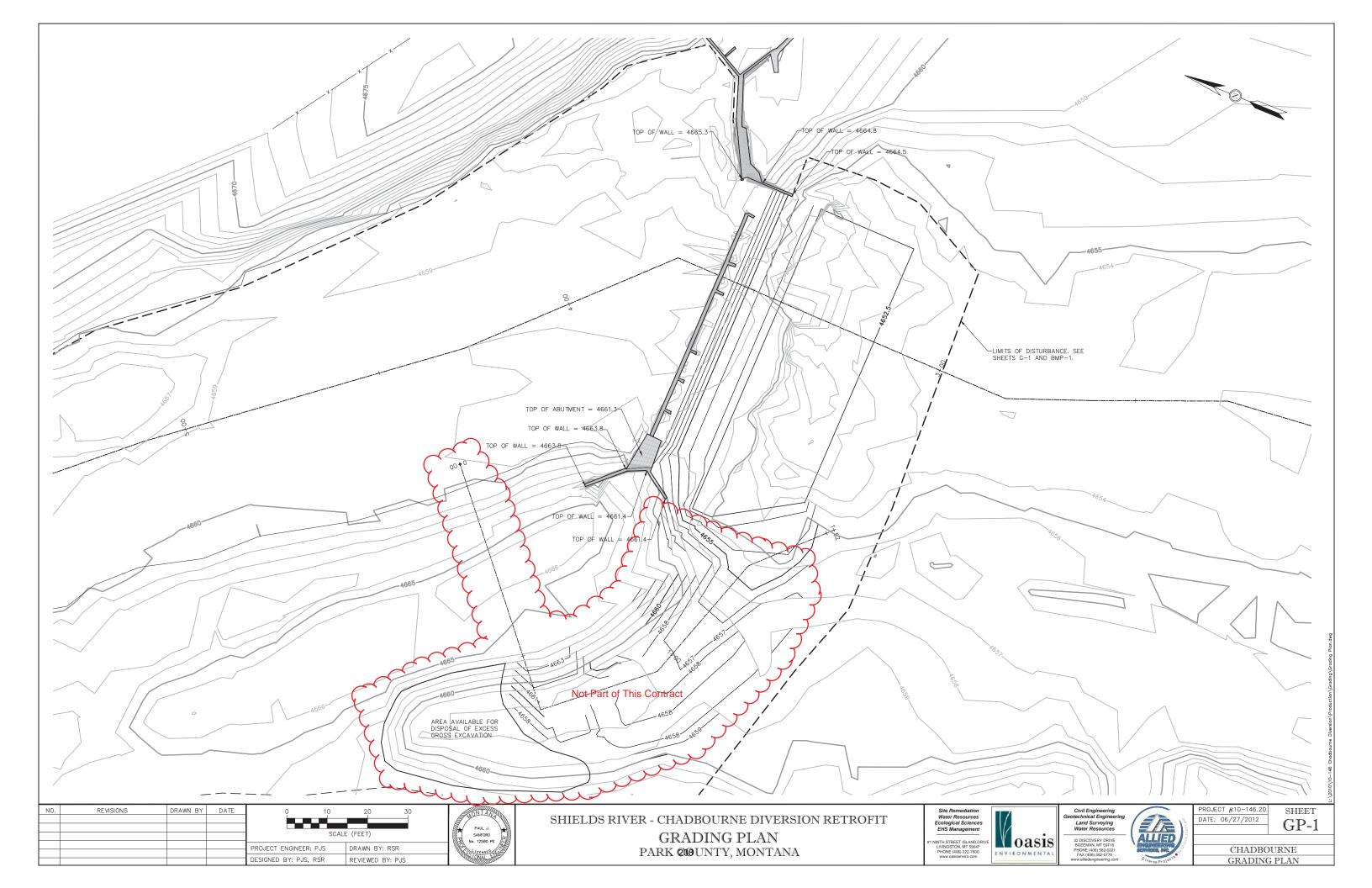
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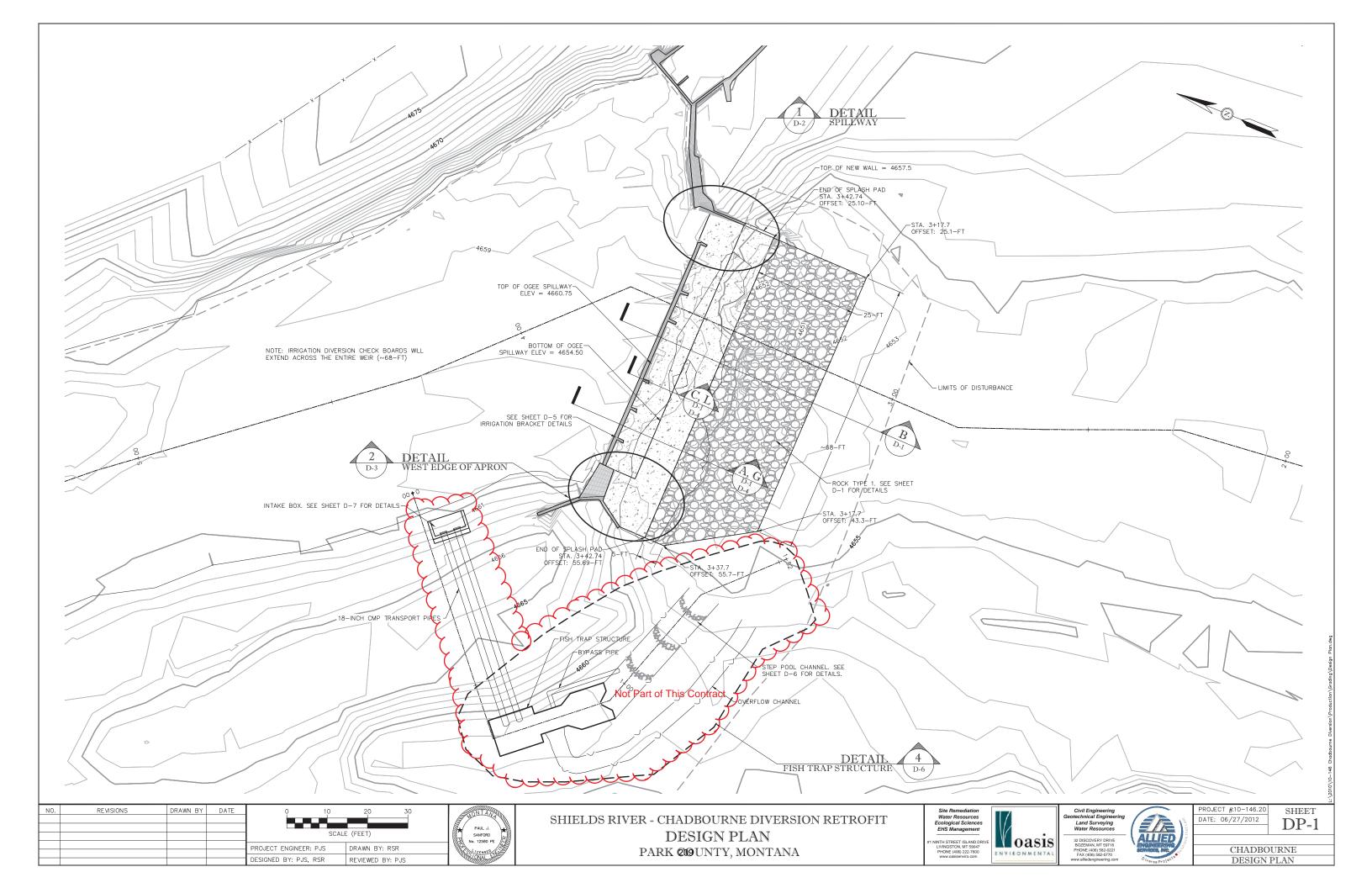
PROJECT #:10-146.20 DATE: 06/27/2012

SHEET G-1

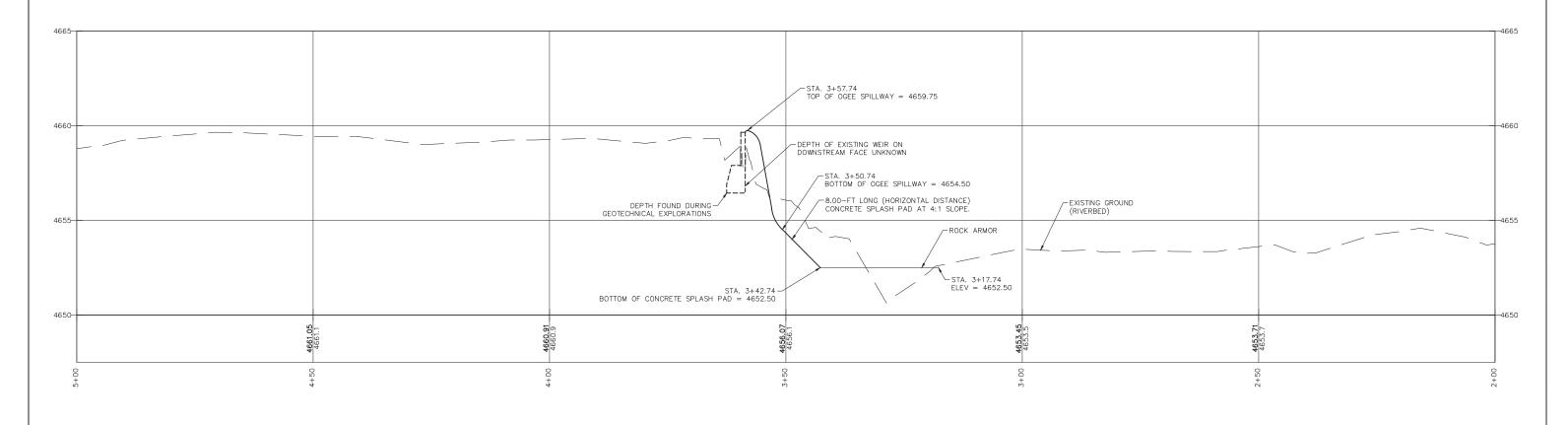
CHADBOURNE PROJECT OVERVIEW







RIVER PROFILE



NO.	REVISIONS	DRAWN BY	DATE	HORIZONTAL SCALE FEET VERTICAL SCALE FEI		
				0 10 20	0 2.5 5	
				PROJECT ENGINEER: PJS	DRAWN BY: RSR	
				DESIGNED BY: PJS, RSR	REVIEWED BY: PJS	



SHIELDS RIVER - CHADBOURNE DIVERSION RETROFIT
PROFILE - MAIN CHANNEL
PARK ©OUNTY, MONTANA





Civil Engineering Geotechnical Engineering Land Surveying Water Resources

ALLIED

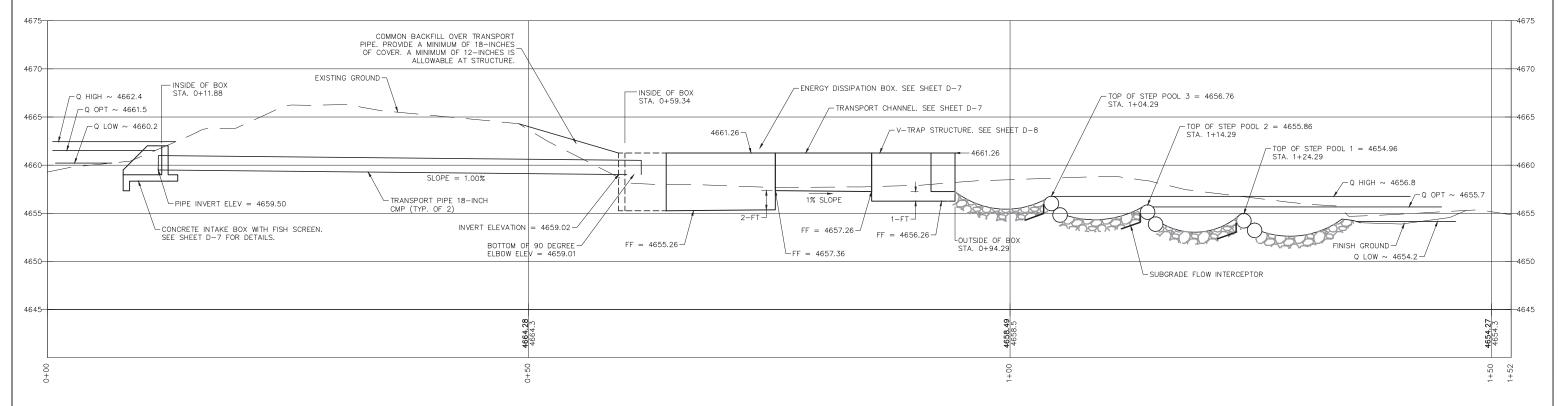
PROJE DATE:

PROJECT #:10-146.20 SHEET PR-1

CHADBOURNE PROFILE - MAIN CHANNEL

FISH PASSAGE

Not Part of This Contract



NOTES:

1. WSE'S LISTED ARE ESTIMATED BASED ON A HYDRAULIC MODEL BY OASIS ENVIRONMENTAL. REFER TO DESIGN CRITERIA MEMO FOR MORE INFORMATION.

NO.	REVISIONS	DRAWN BY	DATE	0 5	10 15	Τ
						1
				SCALE	(FEET)	1
				PROJECT ENGINEER: PJS	DRAWN BY: RSR	┨
				FIXODECT ENGINEER, F03	DIVAMIN DT. IVSIV	4
				DESIGNED BY: PJS, RSR	REVIEWED BY: PJS	⊥



SHIELDS RIVER - CHADBOURNE DIVERSION RETROFIT PROFILE - FISH TRAP CHANNEL PARK **20**UNTY, MONTANA

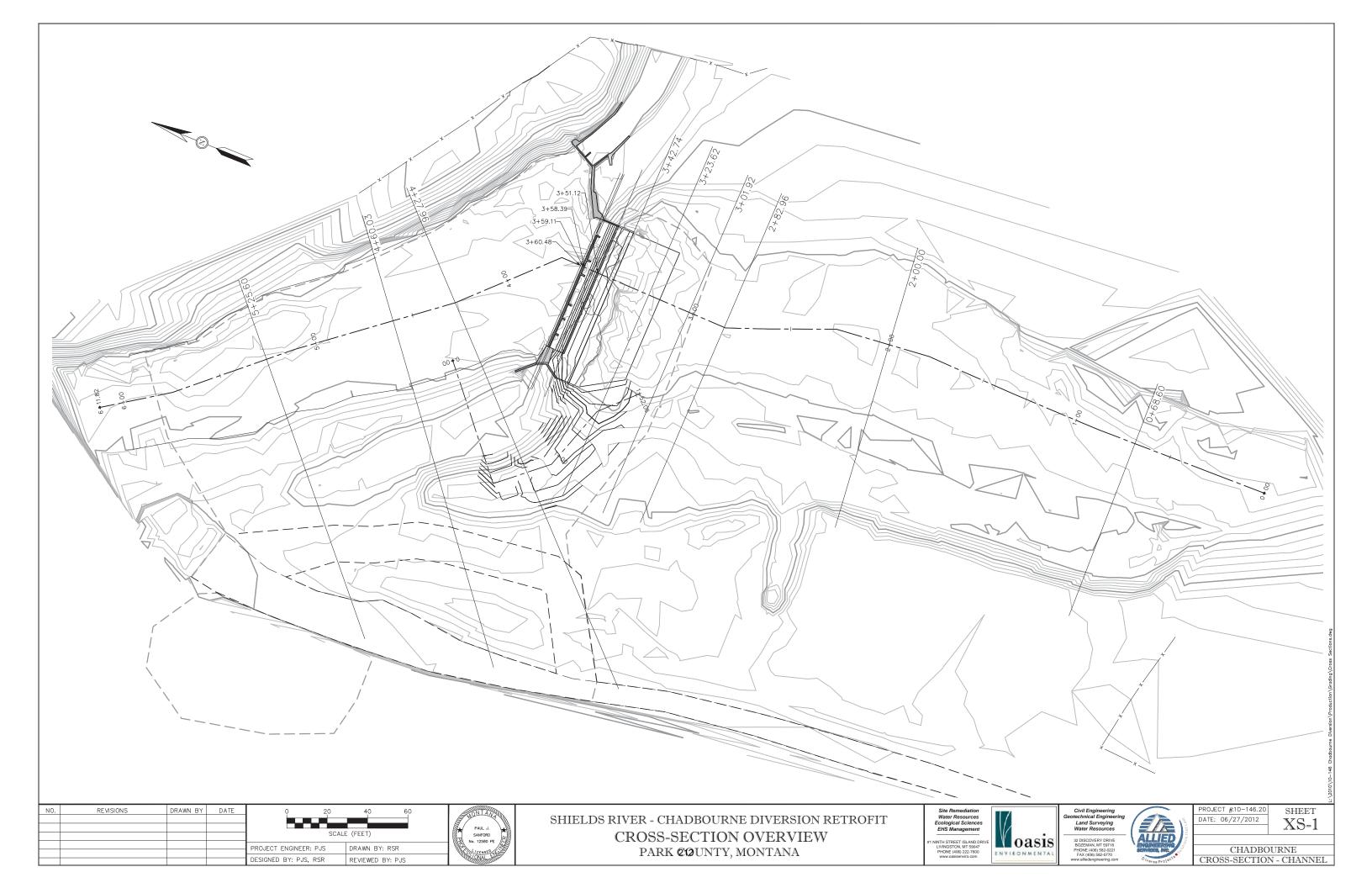


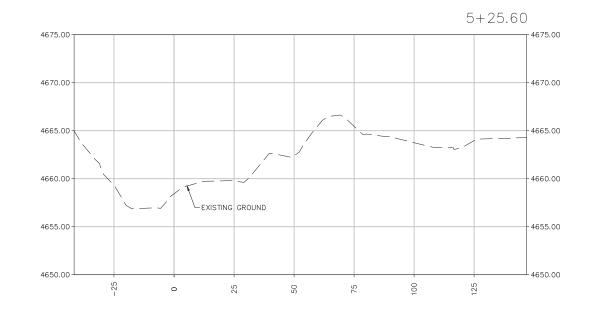
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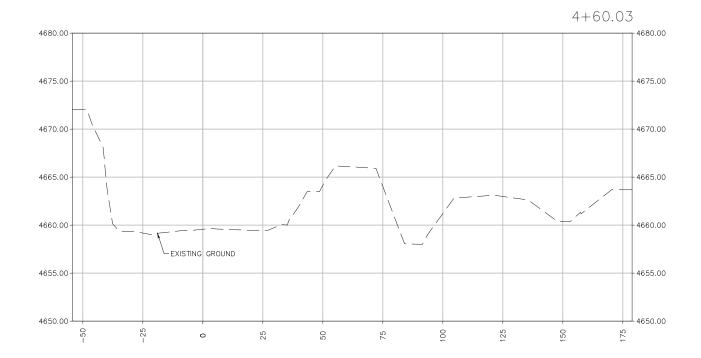
PROJECT #:10-146.20

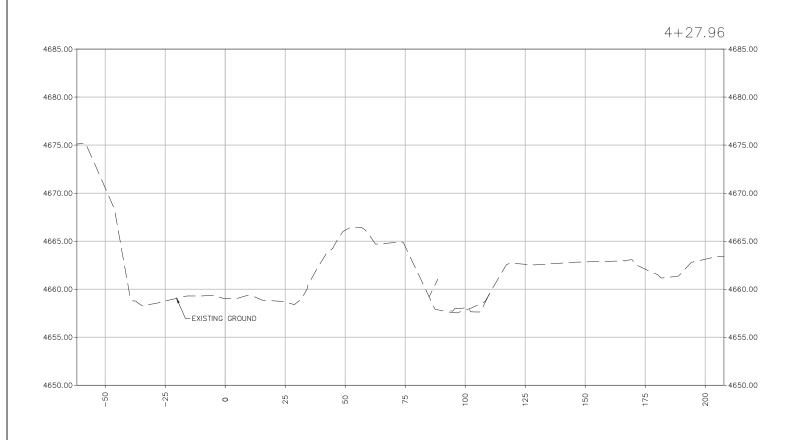
SHEET DATE: 06/27/2012 PR-2

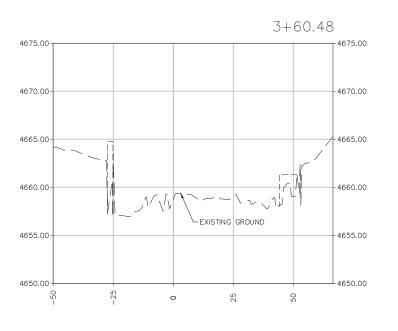
> CHADBOURNE PROFILE - FISH TRAP











REVISIONS DRAWN BY

VERTICAL SCALE FEET HORIZONTAL SCALE FEET PROJECT ENGINEER: PJS DRAWN BY: RSR DESIGNED BY: PJS, RSR REVIEWED BY: PJS



SHIELDS RIVER - CHADBOURNE DIVERSION RETROFIT CROSS-SECTIONS CHANNEL PARK **©**3UNTY, MONTANA

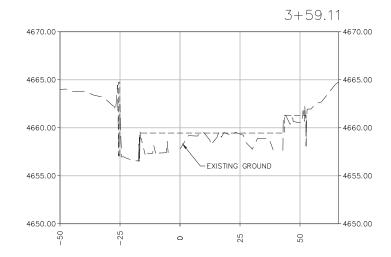
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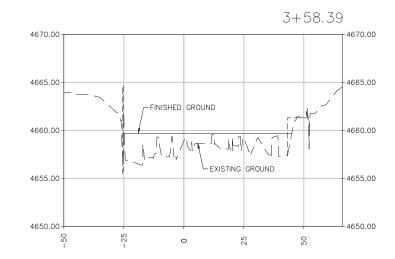
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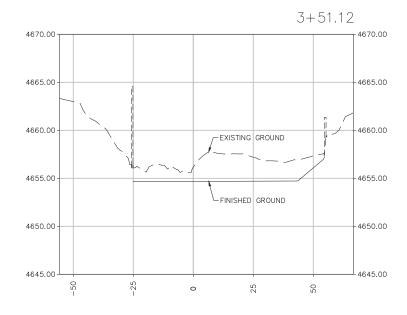
PROJECT #:10-146.20 DATE: 06/27/2012

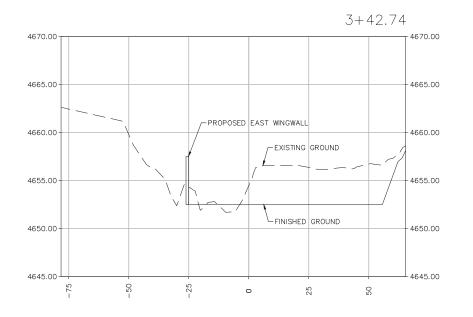
SHEET XS-2

CHADBOURNE CROSS-SECTIONS - CHANNEL









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				0 20 40	0 2 4	
				222 502 5000552 202		
				PROJECT ENGINEER: PJS	DRAWN BY: RSR	
				DESIGNED BY: PJS, RSR	REVIEWED BY: PJS	



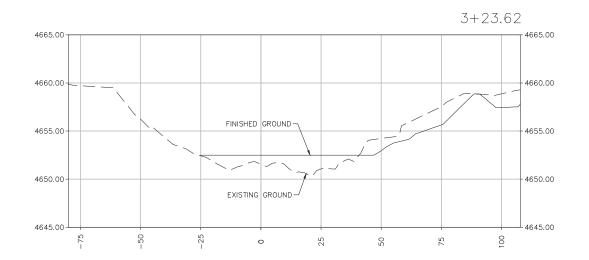


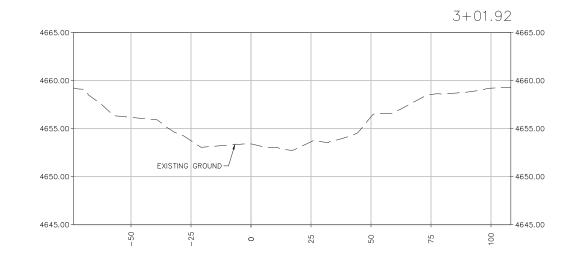


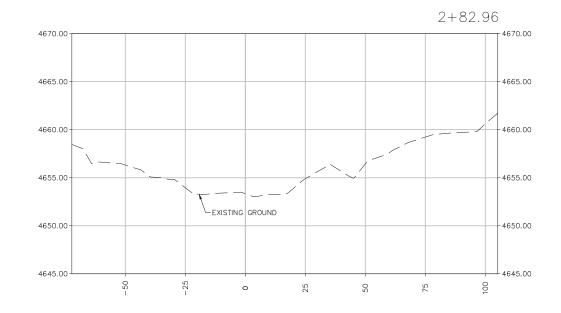
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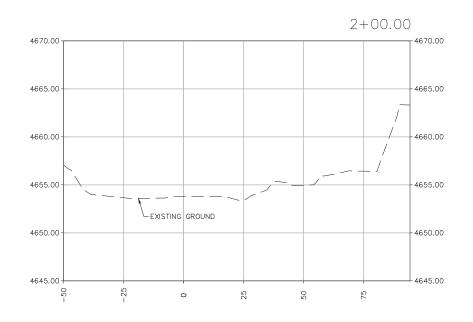
PROJECT #:10-146.20 SHEET DATE: 06/27/2012 XS-3

CHADBOURNE CROSS-SECTION - CHANNEL









VERTICAL SCALE FEET DRAWN BY PROJECT ENGINEER: PJS DRAWN BY: RSR DESIGNED BY: PJS, RSR REVIEWED BY: PJS



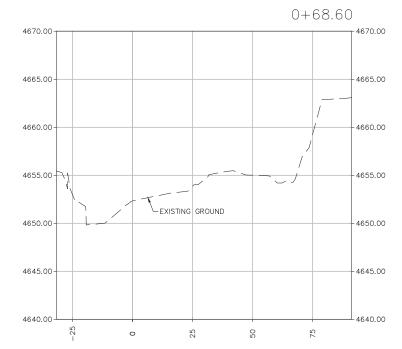
CROSS-SECTIONS - CHANNEL PARK **29**UNTY, MONTANA



PROJECT #:10-146.20 DATE: 06/27/2012

SHEET XS-4

CHADBOURNE CROSS-SECTIONS - CHANNEL



NO.	REVISIONS	DRAWN BY	DATE	HORIZONTAL SCALE FEET	VERTICAL SCALE FEET
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				PROJECT ENGINEER: PJS	DRAWN BY: RSR
				DESIGNED BY: PJS, RSR	REVIEWED BY: PJS



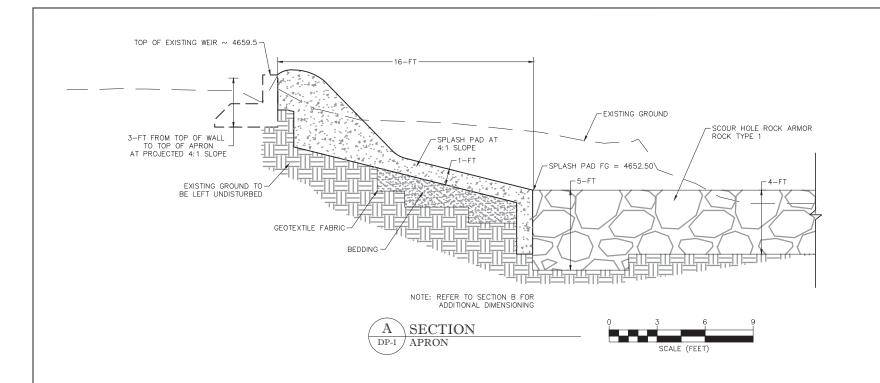
SHIELDS RIVER - CHADBOURNE DIVERSION RETROFIT CROSS-SECTIONS - CHANNEL PARK **216**UNTY, MONTANA



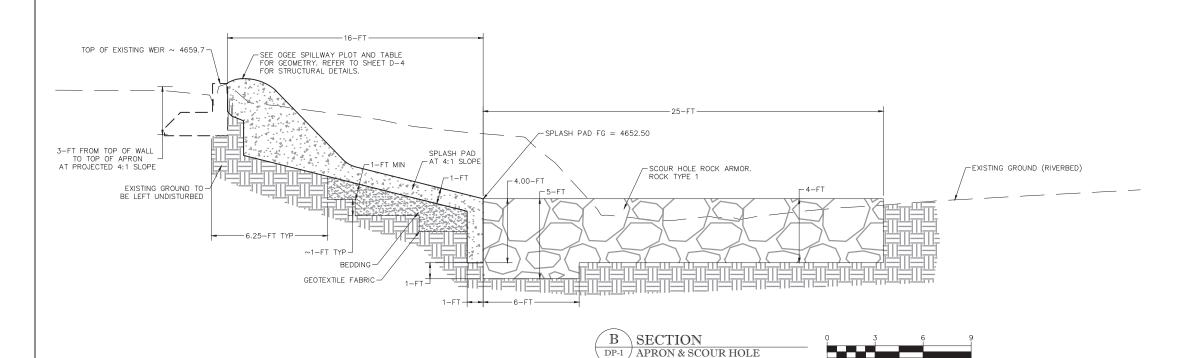
PROJECT #:10-146.20 DATE: 06/27/2012

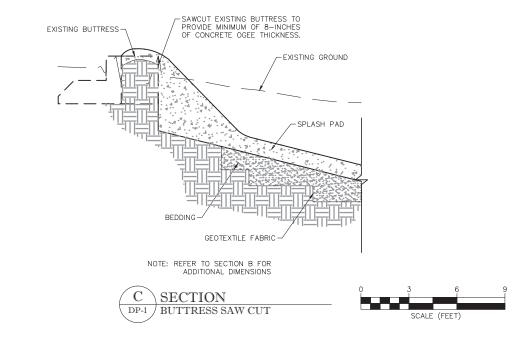
SHEET XS-5

CHADBOURNE CROSS-SECTIONS - CHANNEL

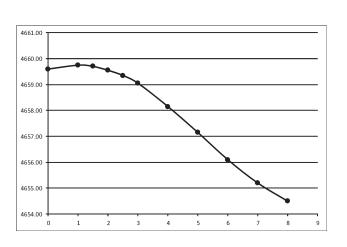


NOTE: REFER TO SPECIFICATIONS SECTION 02500 FISH BARRIER STRUCTURE FOR USE OF FLOWABLE FILL AND STRUCTURAL BACKFILL.





STATION (FROM DOWNSTREAM		
EDGE OF WALL)	ELEVATION	COMMENTS
0	4659.60	(VARIES) CONNECTION TO EXISTING STRUCTURE
1	4659.75	OGEE CREST
1.5	4659.70	
2	4659.55	
2.5	4659.35	
3	4659.05	
4	4658.15	
5	4657.15	
6	4656.10	
7	4655.20	
8	4654.50	END OGEE SHAPE



REVISIONS	DRAWN BY	DATE		
			PROJECT ENGINEER: P IS	DRAWN BY: RSR
			TIKOOLOT LINGINELIK. 1 03	DIVAMIN DT. ICSIC
			DESIGNED BY: PJS, RSR	REVIEWED BY: PJS
	REVISIONS	REVISIONS DRAWN BY	REVISIONS DRAWN BY DATE	PROJECT ENGINEER: PJS



SHIELDS RIVER - CHADBOURNE DIVERSION RETROFIT
DETAILS - FISH BARRIER & CHANNEL
PARK ©OUNTY, MONTANA

Site Remediation Water Resources Ecological Science EHS Management

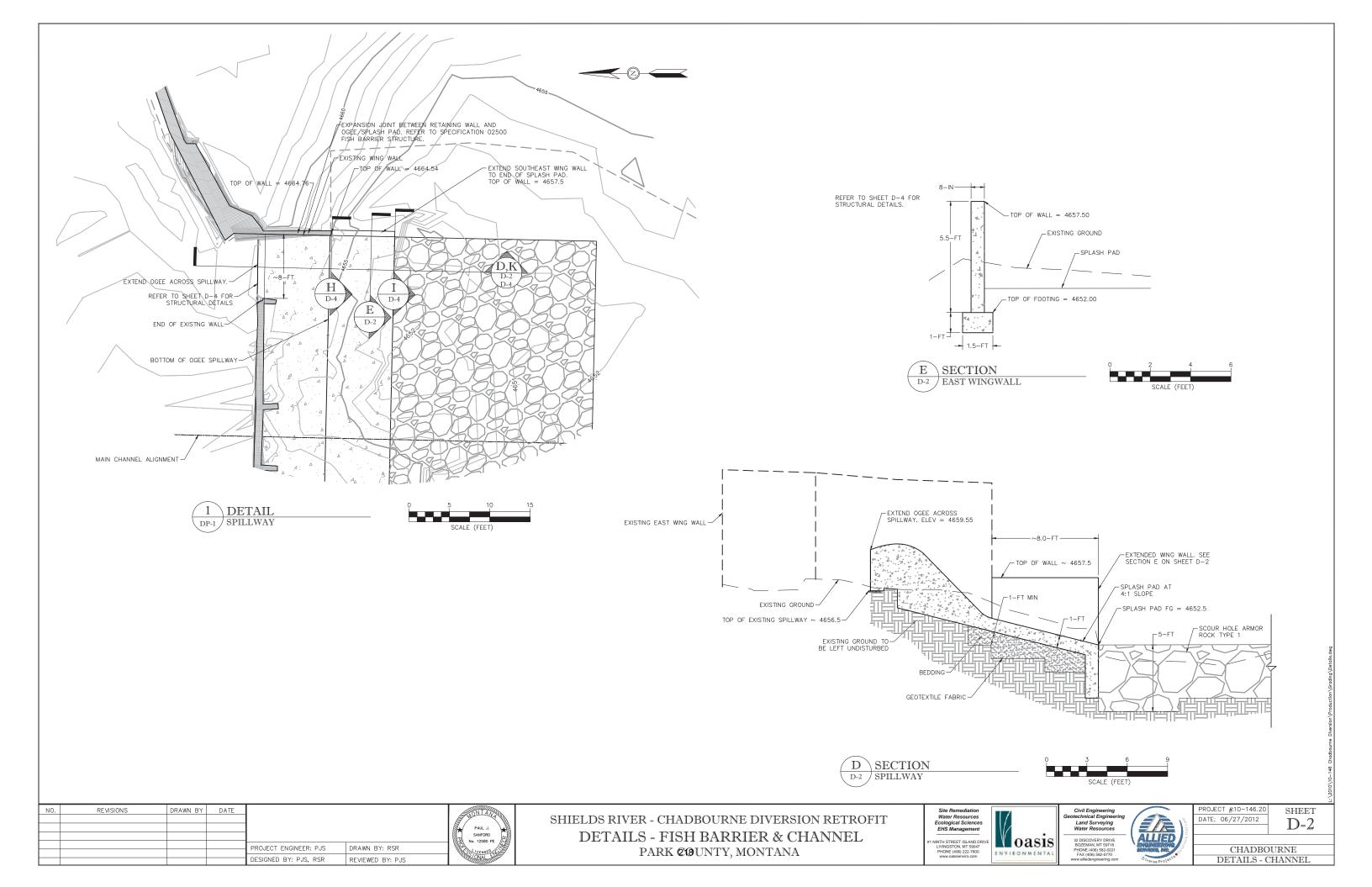


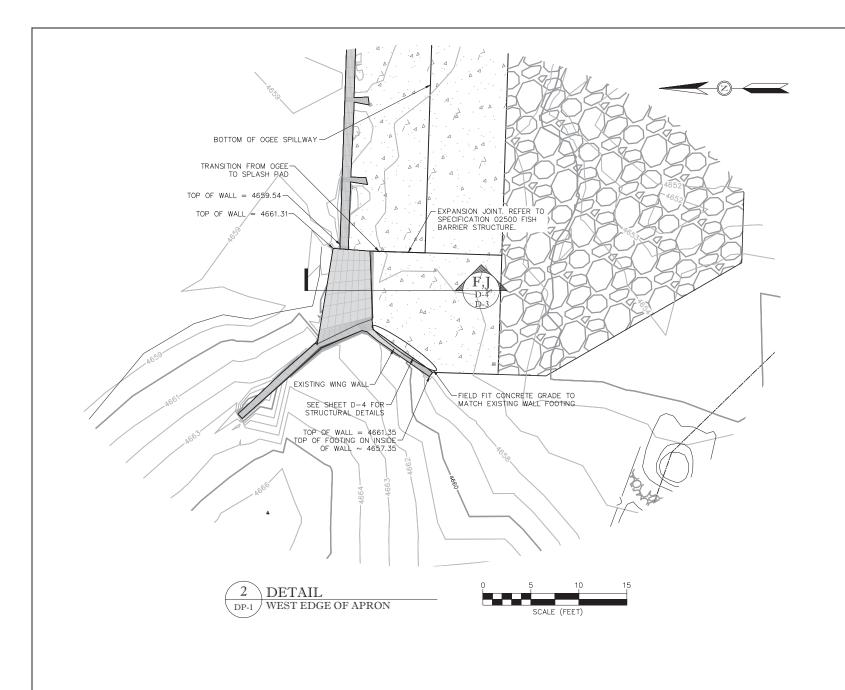
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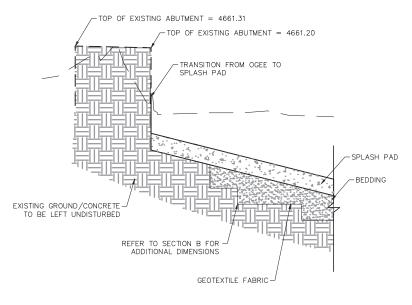
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PROJECT #:10-146.20	SHEET
DATE: 06/27/2012	D 1
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CHADBOURNE DETAILS - CHANNEL







F SECTION
D-3 WEST EDGE OF APRON



REVISIONS	DRAWN BY	DATE		
			PROJECT ENGINEER: PJS	DRAWN BY: RSR
			DESIGNED BY: PJS, RSR	REVIEWED BY: PJS
	REVISIONS	REVISIONS DRAWN BY	REVISIONS DRAWN BY DATE	PROJECT ENGINEER: PJS



SHIELDS RIVER - CHADBOURNE DIVERSION RETROFIT
DETAILS - FISH BARRIER & CHANNEL
PARK ©UNTY, MONTANA





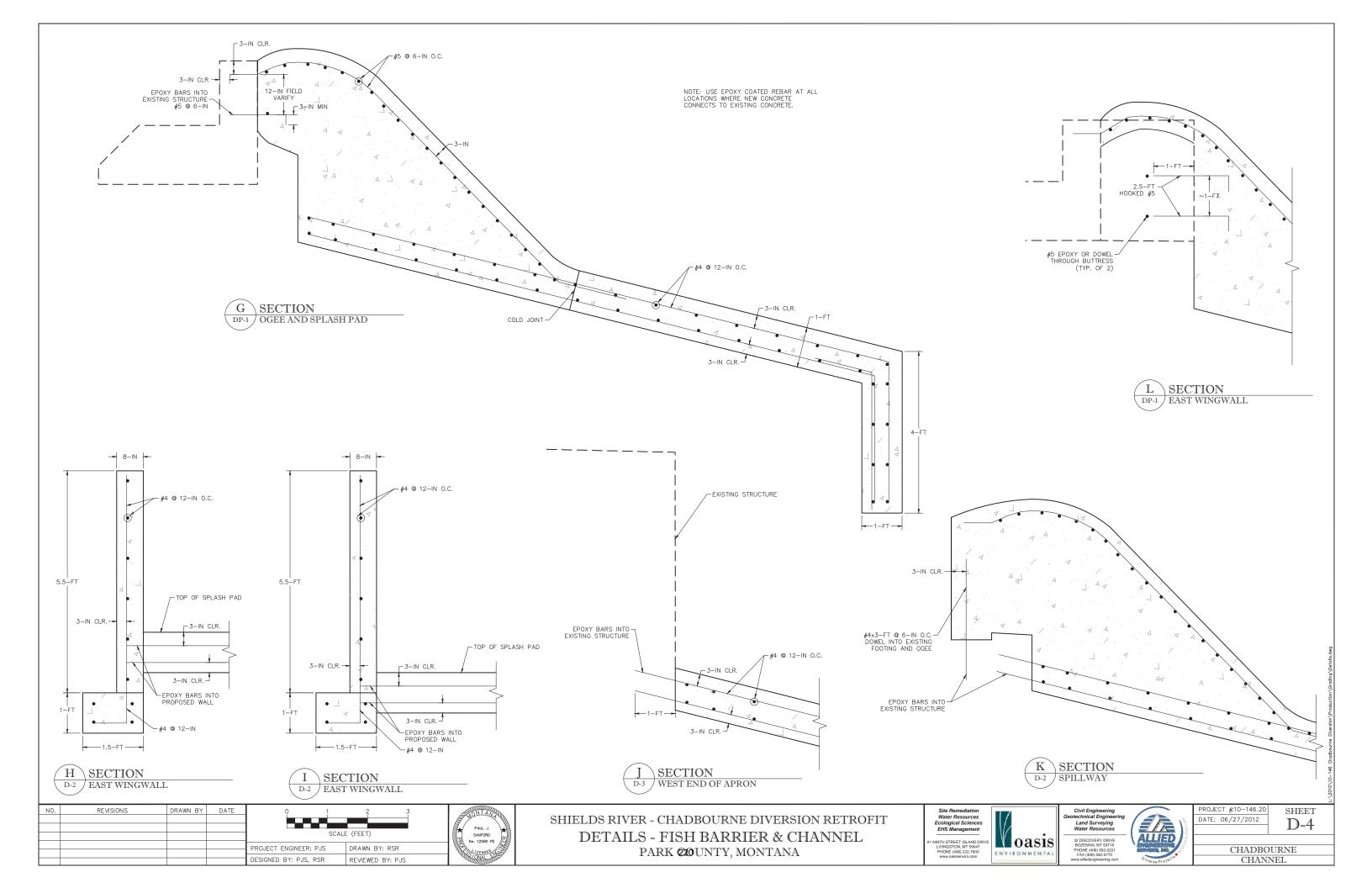
Civil Engineering Geotechnical Engineering Land Surveying Water Resources

ALLED NAME OF THE PARTY OF THE

PROJECT DATE:

PROJECT #:10-146.20 SHEET DATE: 06/27/2012 D-3

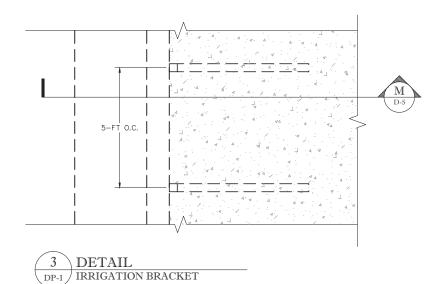
CHADBOURNE CHANNEL



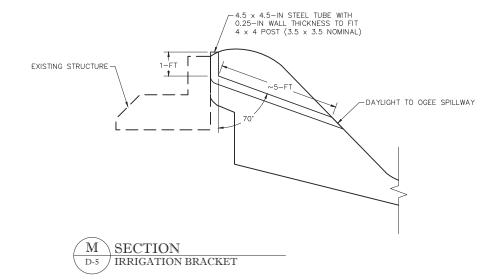
NOTES:

1. IRRIGATION DIVERSION CHECK BOARDS WILL EXTEND ACROSS THE ENTIRE WEIR (~68-FT)

2. REFER TO THE TABLE ON THIS SHEET FOR BRACKET LOCATIONS.



BRACKET NUMBER	DISTANCE FROM INSIDE EDGE OF WEST ABUTMENT WALL
1	4
2	9
3	14
4	19
5	24
6	29
7	34
8	38.5
9	44
10	49
11	54
12	59
13	64



NO.	REVISIONS	DRAWN BY	DATE	0 2	4 6
					(5555)
				SCALE (FEET)	
				PROJECT ENGINEER: PJS	DRAWN BY: RSR
				DESIGNED BY: PJS, RSR	REVIEWED BY: PJS



SHIELDS RIVER - CHADBOURNE DIVERSION RETROFIT DETAILS - FISH BARRIER & CHANNEL PARK **220**UNTY, MONTANA



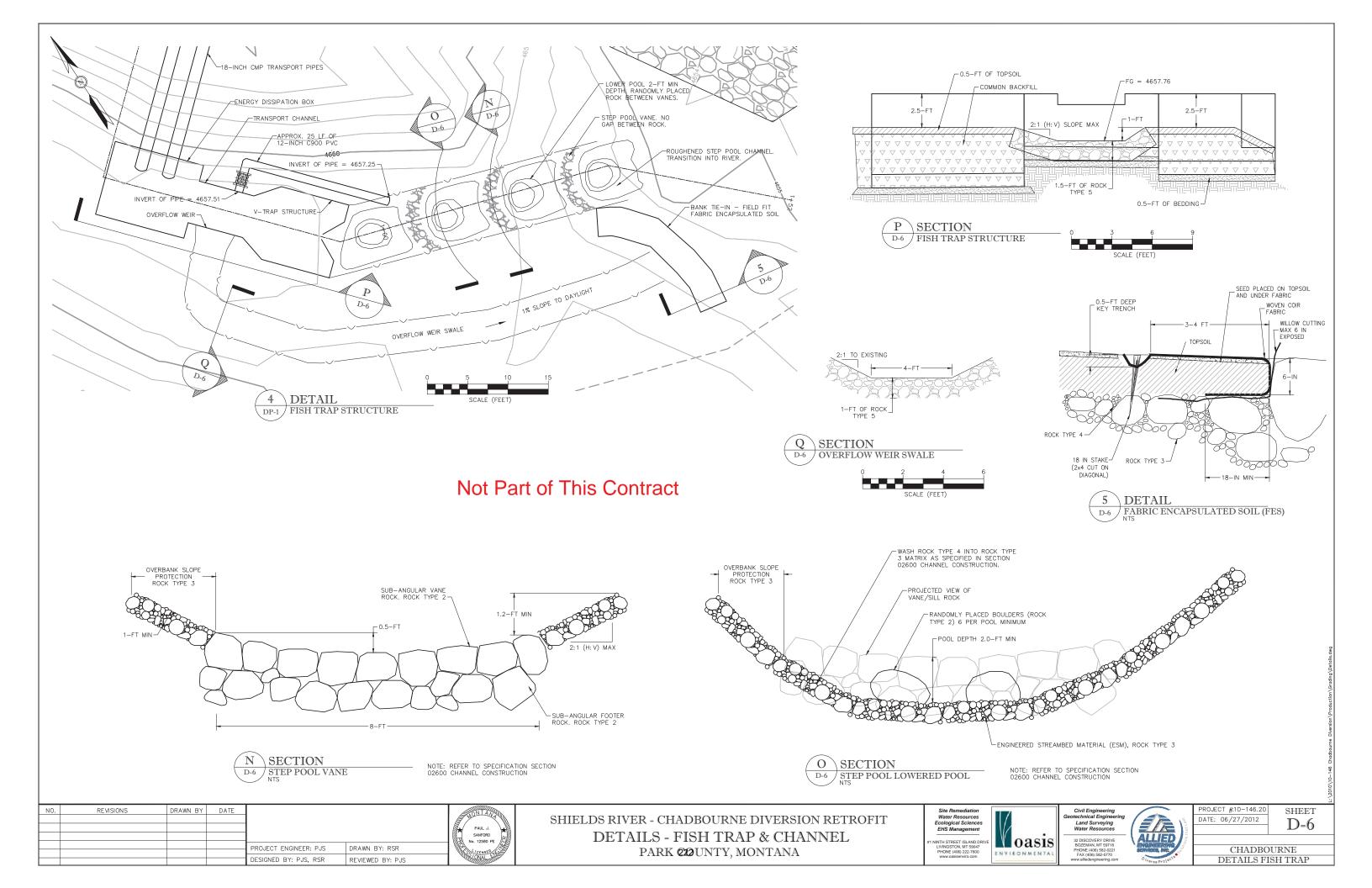
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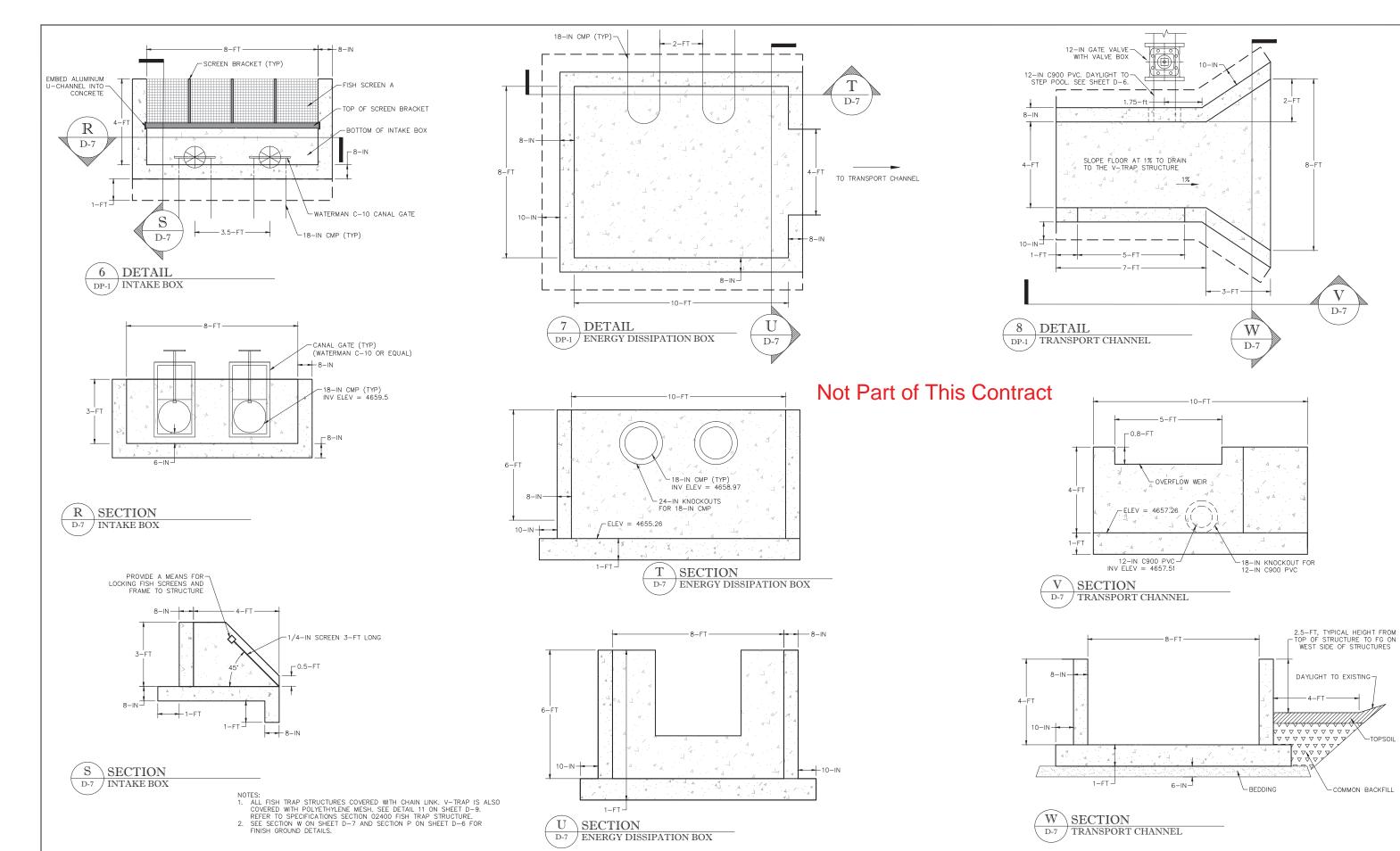
PROJECT #:10-146.20 DATE: 06/27/2012

D-5

SHEET

CHADBOURNE CHANNEL





REVISIONS DRAWN BY DATE PROJECT ENGINEER: PJS DRAWN BY: RSR DESIGNED BY: PJS, RSR REVIEWED BY: PJS



SHIELDS RIVER - CHADBOURNE DIVERSION RETROFIT DETAILS - FISH TRAP & CHANNEL



oasis

ALLIED.

PROJECT #:10-146.20 DATE: 06/27/2012

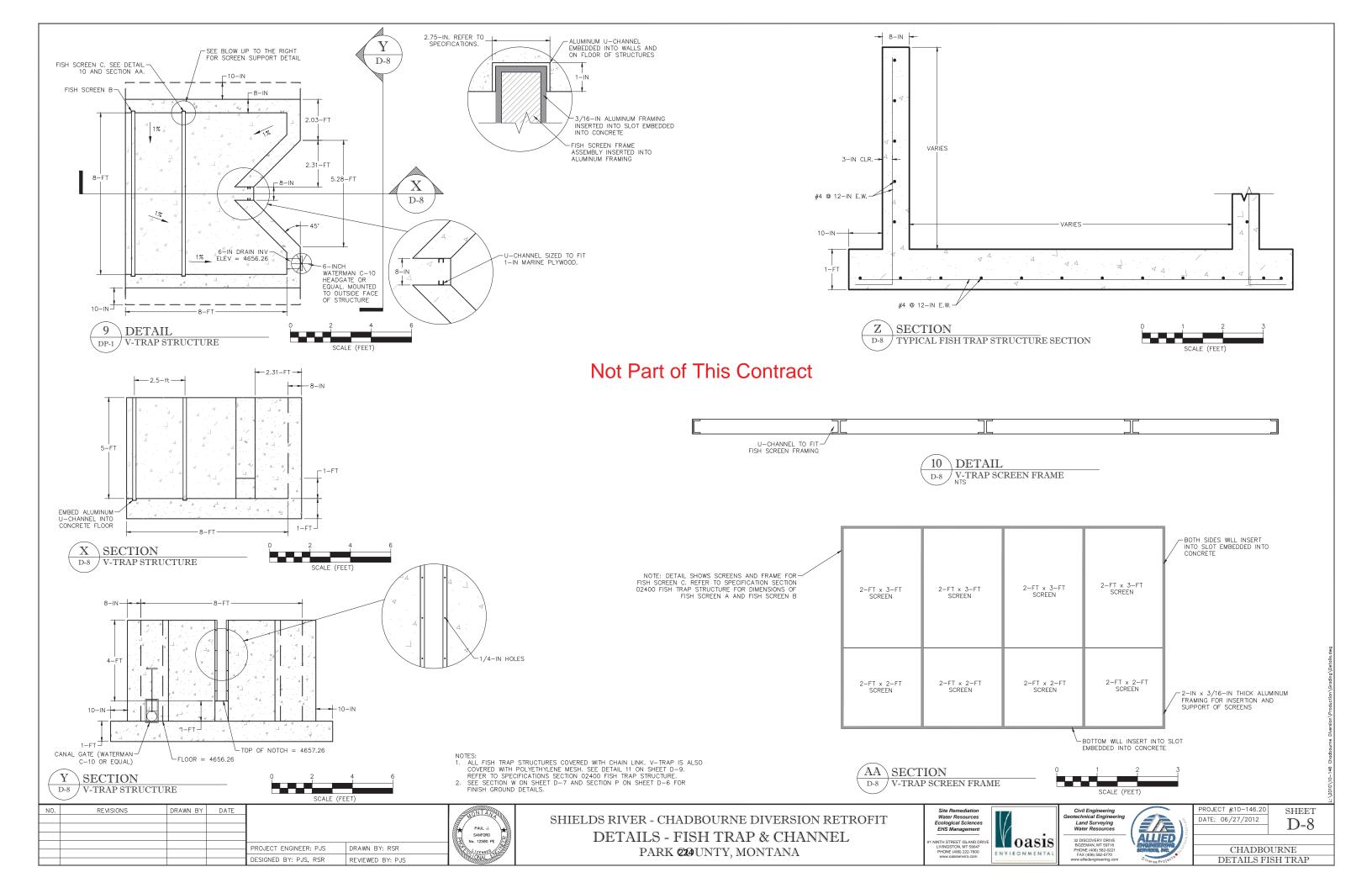
D-7

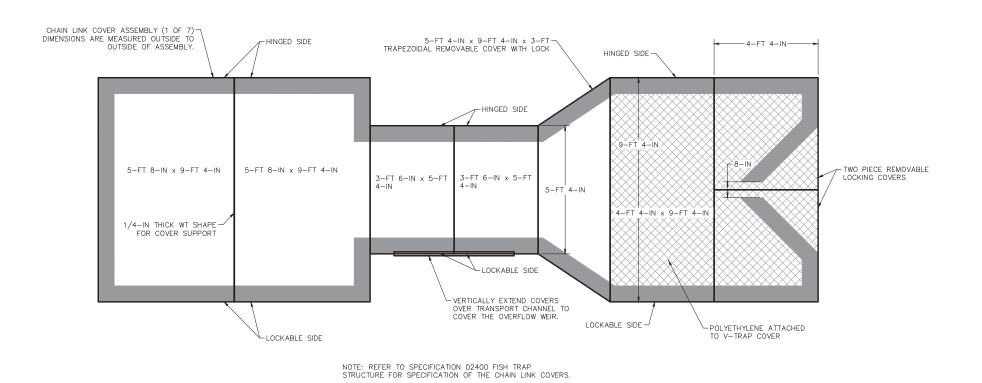
COMMON BACKFILL

SHEET

PARK **223**UNTY, MONTANA

CHADBOURNE DETAILS FISH TRAP





Not Part of This Contract

D-7 | FISH TRAP STRUCTURE CHAIN LINK COVERS

REVISIONS DRAWN BY DATE PROJECT ENGINEER: PJS DRAWN BY: RSR DESIGNED BY: PJS, RSR REVIEWED BY: PJS



11 DETAIL

SHIELDS RIVER - CHADBOURNE DIVERSION RETROFIT DETAILS - FISH TRAP & CHANNEL

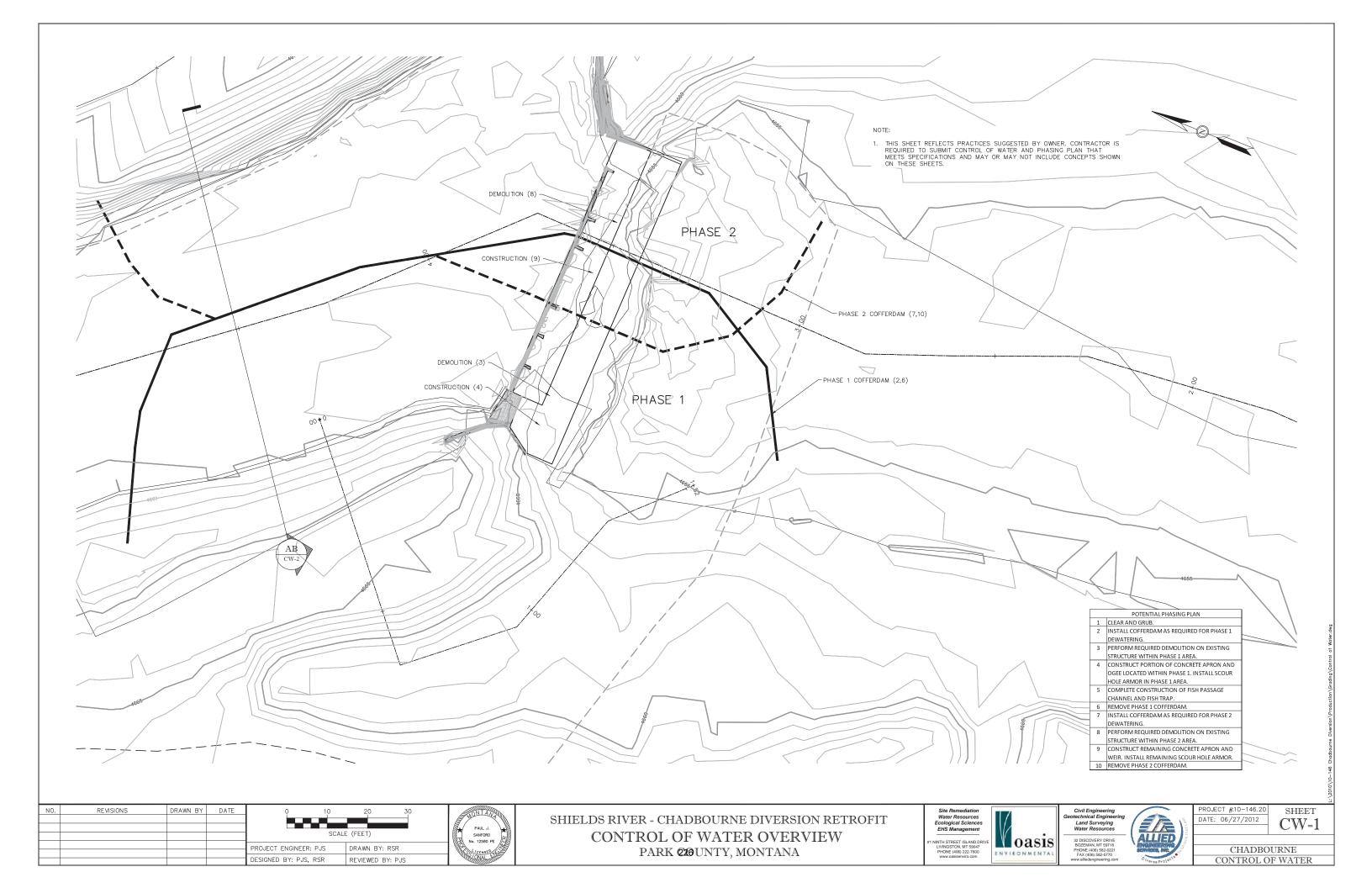


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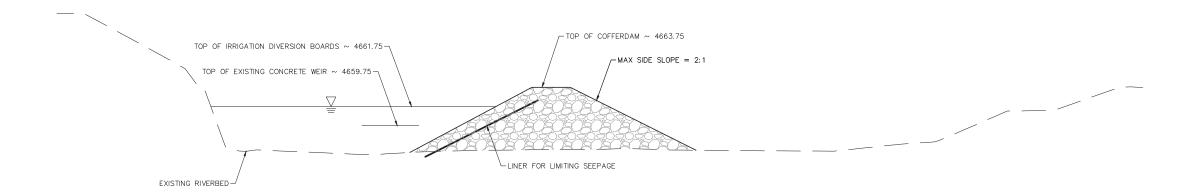
DATE: 06/27/2012

PROJECT #:10-146.20 D-9

> CHADBOURNE DETAILS FISH TRAP



THIS SHEET REFLECTS PRACTICES SUGGESTED BY OWNER. CONTRACTOR IS REQUIRED TO SUBMIT CONTROL OF WATER AND PHASING PLAN THAT MEETS SPECIFICATIONS AND MAY OR MAY NOT INCLUDE CONCEPTS SHOWN ON THESE SHEETS.



AB SECTION CW-1 COFFERDAM



			DATE	DRAWN BY	REVISIONS	Э.
1 Bal						
May "	DRAWN BY: RSR	PROJECT ENGINEER: PJS				
Sim !	BIOTHIC BT. INSIN	DESIGNED BY: PJS, RSR REVIEWED BY: PJS				
- ALE	REVIEWED BY: PJS					



SHIELDS RIVER - CHADBOURNE DIVERSION RETROFIT DETAILS FOR CONTROL OF WATER PARK **227**UNTY, MONTANA

I NINTH STREET ISLAND DRIVE LIVINGSTON, MT 99047 PHONE (469) 222-7800 www.cossienviro.com

ALLIED

PROJECT #:10-146.20 DATE: 06/27/2012

SHEET CW-2

CHADBOURNE CONTROL OF WATER